HUMAN FERTILITY AND ECONOMIC GROWTH IN NIGERIA AND GHANA (1980 – 2023): AN ARDL COMPARATIVE ANALYSIS

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ABSTRACT: This study examined the relationship between human fertility and economic growth in Nigeria and Ghana, utilising annual time series data from 1980 to 2023. The study employed the ARDL estimation technique and found that the impact of the total fertility rate (measured by number of children per woman) on economic growth (measured by real gross domestic product growth rate) differs between the two countries. In Nigeria, the total fertility rate has a negative but not statistically significant effect on economic growth in the short run (-26.6782; P-value 0.1045), but a positive and statistically significant impact in the long run (17.9225; P-value 0.0380). In contrast, Ghana experiences a statistically significant negative effect on economic growth from its total fertility rate in both the short (-8.4670; P-value 0.0005) and long run periods (-10.5597; P-value 0.0028). The study recommends that policymakers in Nigeria focus on long-term economic growth by improving the quality of education and access, implementing family planning programs, and promoting vocational training. In Ghana, policymakers should implement family planning programs, integrate family planning education into school curricula, empower women, and allocate resources for family planning programs and human capital development.

Keywords: Human, Fertility, Economic, Growth, Nigeria, Ghana

INTRODUCTION

High fertility rates can impede economic growth in developing countries by straining resources, infrastructure, and social services (Götmark & Andersson, 2020). This can lead to decreased quality of education, healthcare, and public services, essential for economic growth (Maitra & Ganguli, 2024). High fertility rates also limit female labour force participation, (Yulianita et al., 2020; Bairoliya & Miller, 2021), and lead to decreased savings and investment (Sohail et al., 2024). The Malthusian theory and demographic transition theory provide valuable frameworks for understanding the relationship between population growth (engineered by human fertility) and economic growth (Malthus, 2024; Notestein, 1945). Empirical evidence supports the argument that high fertility rates can hinder economic growth, particularly in countries with limited resources (Huang, 2021; Sohail et al., 2024). Studies have shown that fertility decline can have multifaceted benefits, including improved standard of living and increased economic growth (Sohail et al., 2024; Huang, 2021).

In Africa, the impact of human fertility on economic growth is a pressing concern due to high population growth rates (Gbehe et al., 2024). Countries like Nigeria and Ghana have experienced rapid population growth, straining resources, infrastructure, and social services (Yulianita et al., 2020). Despite progress in reducing poverty and improving living standards (Maitra & Ganguli, 2024), economic growth has been slow, and poverty remains a significant challenge (Huang, 2021). Nigeria's high total fertility rate of 4.6 children per woman (Götmark & Andersson, 2020) has led to rapid population growth, sustaining it status as the most populated African country, and a black nation, with an estimated population of over 200 million people (Sohail et al., 2024). In Nigeria, economic growth has been slow, and poverty persists (Aigheyisi & Oligbi, 2019). The same could be said of Ghana who shared similar economic structure and colonial history with Nigeria.

According to the World Bank's World Development Indicators (WDI, 2024), Nigeria and Ghana's total fertility rates (TFR) and real GDP have exhibited a notable trend. Over the past four decades, both countries have experienced a decline in TFR, accompanied by an increase in real GDP. In Nigeria, the average TFR declined from 6.66 children per woman in 1980-1989 to 5.27 children per woman in 2020-2023, while real GDP increased from $130 billion to $520.237 billion. Similarly, in Ghana, the average TFR declined from 6.21 children per woman in 1980-1989 to 3.59 children per woman in 2020-2023, while real GDP increased from $10.721 billion to $65.937 billion. This trend suggests a negative relationship between TFR and real GDP, where declining fertility rates are associated with economic growth. The data suggest a negative relationship between total fertility rate and real GDP in both Nigeria and Ghana over the past four decades. As the total fertility rate declined, real GDP increased in both countries. This trend suggests that there may be a relationship between fertility rates and economic growth, with lower fertility rates potentially contributing to higher economic growth. This study aims to investigate the relationship between human fertility and economic growth in Nigeria and Ghana, with a view to understanding the impact of fertility rates on economic growth in both countries and comparing them.

Studies on the relationship between fertility rates and economic growth has yielded mixed results, with studies such as Sohail et al. (2024) and Maitra and Ganguli (2024) finding a negative relationship, while others like Gbehe et al. (2024) and Huang (2024) found a positive relationship. Some studies have also found complex or non-linear relationships, such as Li and Zhao (2022) and Dominiak et al. (2015). Given these mixed findings, this study investigated the impact of human fertility on economic growth in Nigeria and Ghana, two countries in West Africa with high fertility rates and rapid population growth. The study examined the relationship between total fertility rate and GDP growth rate in both countries over a 44-year period, from 1980 to 2023.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Conceptual literature

Human Fertility

Human fertility refers to the ability of the populations to produce offspring and is typically measured by the total fertility rate (TFR), which is the average number of children a woman would have in her lifetime (Götmark & Andersson, 2020). A large and growing population can provide a

substantial workforce, contributing to economic growth, and potentially yielding a demographic dividend when the working-age population exceeds the dependent population (Bloom & Williamson, 1998; Bloom et al., 2003). However, high fertility rates can strain a country's resources, infrastructure, and social services, making it challenging to provide adequate education, healthcare, and employment opportunities (Malthus, 2024). This can lead to a high dependency ratio, limiting investments in human capital and infrastructure (Kelley & Schmidt, 1995; Lawal et al., 2024). Furthermore, high fertility rates can perpetuate poverty and inequality, particularly in developing countries where large family sizes are associated with lower incomes, limited access to education, and inadequate healthcare (Yulianita et al., 2020; Sohail et al., 2024).

Economic Growth

Economic growth refers to the increase in the production of goods and services within an economy over a specified period. It is typically measured by the percentage change in the gross domestic product (GDP) or the gross national product (GNP) (Mankiw, 2019).

Theoretical literature review

The Malthusian theory

The Malthusian theory, propounded by Thomas Robert Malthus in 1798, is a demographic theory that explains the relationship between population growth and economic development (Malthus, 2024). According to Malthus, population growth tends to outstrip the growth of food supply, leading to poverty, famine, and societal instability. The theory is based on two postulates: population growth is inevitable, and food supply is limited (Malthus, 2024). Malthus assumed that population grows geometrically, while food supply grows arithmetically, leading to a mismatch between the two (Malthus, 2024).

The theory highlights the potential challenges that rapid population growth can pose for economic development, particularly in countries with limited resources (Götmark & Andersson, 2020). The Malthusian Theory is particularly relevant to this study, as it suggests that rapid population growth can lead to a decrease in living standards and an increase in poverty, which is consistent with the experiences of many developing countries (Sohail et al., 2024).

The Endogenous Growth Theory

The endogenous growth theory, proposed by Paul Romer in 1986, explains how economic growth is driven by endogenous factors, including investments in human capital, technological progress, and institutional factors (Romer, 1986). According to Romer, economic growth is not solely determined by external factors, such as population growth or technological progress, but rather by internal factors that are within the control of individuals, firms, and governments (Romer, 1990). The theory emphasizes the importance of investments in education, research and development, and institutional factors, such as property rights and the rule of law, in driving economic growth (Romer, 1994). The endogenous growth theory is based on several key assumptions, including the idea that knowledge is a non-rivalrous good, meaning that multiple individuals and firms can use it without

reducing its value (Romer, 1986). Additionally, the theory assumes that human capital is essential for economic growth and that institutional factors matter in driving economic growth (Lucas, 1988).

The theory emphasises the significance of investments in human capital and institutional factors in driving economic growth, which is crucial for understanding the relationship between human fertility and economic development.

Empirical literature review

The relationship between fertility rates and economic growth has been extensively studied, yielding diverse findings. Time-series studies have predominantly reported negative relationships, with Sohail et al. (2024) finding that fertility decline improves living standards and boosts economic growth in China using the Quantile Autoregressive Distributed Lag (QARDL) model. Similarly, Maitra and Ganguli (2024) discovered a dual impact of fertility decline on income growth in India, with adverse effects in the short run but positive effects in the long run, employing the Autoregressive Distributed Lag (ARDL) model. Aigheyisi and Oligbi (2019) also found a significant negative relationship between adolescent fertility and economic growth in Nigeria using ARDL bounds test, FMOLS, and CCR.

In contrast, panel studies have reported both positive and negative relationships. Gbehe et al. (2024) found a positive, long-run relationship between demographic structure and economic growth in 26 sub-Saharan African countries using PMG-ARDL, FMOLS, and DOLS. Yulianita et al. (2020) discovered that fertility decline positively impacts per capita income growth in Southeast Asia using ARDL panel model with PMG, MG, and DFE estimators. Conversely, Huang (2021) found that secular fertility declines significantly drive slowing global economic growth using a long-term lagged panel model. Non-linear relationships have also been explored, with Dominiak et al. (2015) finding a U-shaped relationship between total fertility rate and economic growth in 18 countries, and Li and Zhao (2022) reporting an inverted U-shaped relationship between birth rates and human capital accumulation in China.

Furthermore, studies have highlighted short-run and long-run heterogeneity in the relationship between fertility rates and economic growth. For instance, Maitra and Ganguli (2024) and Sohail et al. (2024) found differing effects of fertility decline in the short and long run. Maitra and Ganguli (2024) found that fertility decline has detrimental effects on income growth in the short run but positive effects in the long run in India. Sohail et al. (2024) found that fertility reduction has a dampening effect on capital investment rates in the short run but a positive impact on economic growth in the long run in China.

Long-run heterogeneity has also been observed, with Huang (2021) finding that secular fertility declines have a profoundly negative impact on long-term economic growth. Gbehe et al. (2024) found a positive, long-run relationship between demographic structure and economic growth in sub-Saharan Africa.

Also, some studies have challenged conventional wisdom on the relationship between fertility rates and economic growth. Huang (2024) found that higher fertility rates initially suppress economic

growth but ultimately yield a significantly positive long-term average effect. Similarly, Marois et al. (2021) argued that China's low fertility rates will not inevitably hinder its prosperity, proposing a more nuanced measure of demographic prospects that incorporates labour force participation and educational attainment. Gehrke and Kubitza (2024) discovered a consistent negative correlation between agricultural productivity growth and fertility rates, attributing this finding to the transformative impact of rising farm profits on consumption growth, education, and labour market outcomes. Bairoliya and Miller (2021) found that a fertility rebound in China would lead to lower education shares and income per capita, but education policy interventions could mitigate these adverse outcomes. Ohinata and Varvarigos (2020) confirmed the "fertility rebound" phenomenon, where fertility dynamics follow an N-shaped curve. Cross-country analyses by Götmark and Andersson (2020), Fox et al. (2019), and Chatterjee and Vogl (2018) revealed distinct patterns and correlations between fertility rates, economic development, and other factors. Lacalle-Calderon et al. (2017) found an inverse J-shaped pattern between economic development and fertility, contingent upon attaining a critical threshold of economic development. The empirical literature suggests that the relationship between fertility rates and economic growth may depend on the country being studied.

Research gap

A significant research gap still exists in the study of human fertility and its impact on economic growth, particularly in the context of Sub-Saharan African countries. While existing literature has primarily focused on developed economies or aggregated data from multiple countries, there is a scarcity of comparative studies examining the specific contexts of countries like Nigeria and Ghana. These two countries share similar cultural and economic characteristics but have distinct demographic profiles, making them ideal for comparative study. This study would contribute to the existing literature by providing new findings into the impact of human fertility and economic growth in Nigeria and Chana.

RESEARCH METHODOLOGY

Research design

This study investigated the comparative efficacy of human fertility on economic growth in Nigeria and Ghana. Human fertility was proxied by the total fertility rate, and economic growth was captured as real GDP. To achieve this, the study adopts an ex post facto research design. This is premised on the fact that the design creates an opportunity to evaluate events that have already occurred by collecting relevant secondary data to determine the cause-and-effect relationships among the relevant variables. The design employs empirical estimation techniques to estimate the causal relationship between the dependent and independent variables (Giuffre, 1997; Rohwer, 2022).

Model specification

The human-fertility-economic growth equation is anchored on the endogenous growth theory and supported by the Malthusian theory. Endogenous growth theory is generated within a system as a

direct result of internal processes, such as human capital, innovation, and investment capital, rather than external, uncontrollable forces. Thus, the model can be functionally specified as follows:

$$RGDPGR = f(\text{GOVEX, MSGR, PKY, LAB, INFRA, TFR)} \qquad 2$$

Where:

RGDPGR = real GDP growth rate, it represents output in the model and is a proxied for economic growth, measured in percentage.

PKY = physical capital, whichrepresents capital in the model and is measured in Nigerian naira and proxied by gross fixed capital formation

LAB = total labour force. It represents labour in the model and is measured in the number of working-age population.

INFRA = Infrastructure. Proxied by the access to electricity share of the population

GOVEX =government expenditure. Measured in Nigerian naira.

MSGR = Money supply growth rate. Measured in Nigerian naira.

TFR = Total fertility rate, measured in percentage

The mathematicalspecification of equation 2 is given as:

$$RGDPGR = a_0 + a_1\text{PKY} + a_2\text{LAB} + a_3\text{INFRA} + a_4\text{GOVEX} + a_5\text{MSGR} + a_6\text{TFR} \qquad 3$$

The econometric specification of equation 3 is given as:

$$RGDPGR = a_0 + a_1\text{PKY} + a_2\text{LAB} + a_3\text{INFRA} + a_4\text{GOVEX} + a_5\text{MSGR} + a_6\text{TFR} + e_1 \, 4$$

Equation 4 can be written in log-linear form, because some of the variables involved are dominated in percentage and some at the level, which will allow us to interpret the coefficients of the independent variables as the elasticity of the dependent variable.

$$RGDPGR = a_0 + a_1 \log(\text{PKY}) + a_2 \log(\text{LAB}) + a_3 \text{INFRA} + a_4 \log(\text{GOVEX}) + a_5 \text{MSGR} + a_6\text{TFR} + e_1 \quad 5$$

Where:

e_1 is the error term, which represents all other variables that affect economic growth not captured by the human-fertility-economic growth model. α_0 is the constant term while α_1, α_2, α_3, α_4, α_5 and α_6, are parameters of log (PKY), log (LAB), INFRA, log (GOVEX), MSGR, and TFR respectively.

Definition of variables and theoretical expectations

RGDPGR = Real GDP growth rate, a proxy for economic growth, measured in percentage. This is the dependent variable in the specified model.

PKY = physical capital. This is represented by gross fixed capital formation. Increasing capital stock through machinery, tools, and equipment should enhance economic growth. PKY is expected to have a positive impact on economic growth.

LAB = total labour force. This is the number of people working at the prevailing wage in an economy. The apriori expectation is that an increase in the labour force should bring about an increase in economic growth.

INFRA = Infrastructure is proxied by access to electricity, share of the population. It is expected to have a positive impact on economic growth.

GOVEX = Government expenditure refers to the amount of money the government spends on goods, programs, and services to support the public and pay interest from borrowing. Government expenditure is expected to have a positive impact on economic growth.

MSGR = Growth rate of Broad money supply, is a measure of the change in money supply in a national economy over time, this includes both changes in highly liquid "narrow money" and less liquid forms. An increase in the money supply can stimulate spending and investment.

TFR = Total fertility rate. The total fertility rate (TFR) represents the average number of children a woman is expected to have in her lifetime, based on the current fertility rates of a population. It is a key indicator of a population's growth rate and is usually expressed as the number of children per woman. It is expected to have a negative impact on economic growth.

Estimation techniques

Several estimation techniques were employed in this study to test and estimate the specified models. These include the unit root test as well as the Autoregressive Distributed Lag model (ARDL) bounds test approach. The ARDL method was chosen because of the mixed stationarity results of the study's variables for both Nigeria and Ghana, which were at level,1(0), and after first difference I(1), but none were at after second difference, I(2).

Sources of data

The main sources of data collection for this study are secondary sources. These sources include the Central Bank of Nigeria statistical bulletin, the National Bureau of Statistics (NBS), and the World Bank's World Development Indicators. Data was collected on a yearly basis from 1980 to 2023.

Limitations of the study

The study's findings may be limited by its use of annual data, which is typically aggregated on a daily, monthly, or quarterly basis. High-frequency data would have been suitable, but the non-availability of quarterly data from WDI and other sources does not affect the results.

DATA PRESENTATION, ANALYSIS AND DISCUSSION OF FINDINGS

Presentation of data

Descriptive statistics of the variables in Nigeria and Ghana's variables

The descriptive statistics for Nigeria and Ghana reveal notable differences in key economic and demographic variables. Ghana's real GDP growth rate averaged 4.48% (range: -6.92% to 14.05%), while Nigeria's averaged 3.08% (range: -13.13% to 15.33%). Total fertility rates were higher in Nigeria (6.09%) than Ghana (4.88%). Access to electricity, used as a proxy for infrastructure, was slightly higher in Ghana (49.79%) than Nigeria (43.94%). Labour force and government expenditure also varied between the two countries.

Table 1: Descriptive statistics of the Nigeria and Ghana's variables, 1980 to 2023

	RGDPGR	TFR	GOVEX	INFRA	LAB	MSGR	PKY
NIGERIA							
	%	%	N Billion	%	Labour	%	$ million
Mean	3.08	6.09	2,420	43.94	46,575,190	23.03	38,800
Median	3.55	6.10	1,020	44.75	43,574,263	18.12	26,900
Maximum	15.33	6.85	7,810	60.50	75,721,345	87.76	81,300
Minimum	-13.13	5.24	9.64	27.30	32,071,639	-0.79	9,520
Std. Dev.	5.20	0.45	2,750	10.58	13,723,523	17.58	25,300
Skewness	-0.87	-0.29	0.77	-0.08	0.55	1.48	0.46
Kurtosis	4.97	2.28	2.05	1.65	2.02	5.80	1.54
Jarque-Bera	12.69	1.55	6.02	3.40	3.98	30.55	5.43
Probability	0.00	0.46	0.05	0.18	0.14	0.00	0.07
Observations	44	44	44	44	44	44	44
GHANA							
	RGDPGR	TFR	GOVEX	INFRA	LAB	MSGR	PKY
	%	%	Cedis Billion	%	Labour	%	$ million
Mean	4.48	4.88	2.020	49.79	9,270,454	34.92	4,480

Median	4.79	4.79	0.851	43.70	8,727,477	33.99	1,640
Maximum	14.05	6.52	6.37	86.30	14,549,322	56.53	15,100
Minimum	-6.92	3.56	0.238	30.37	6,500,660	13.30	153
Std. Dev.	3.55	0.92	1.93	20.01	2,622,537	12.70	5,100
Skewness	-0.85	0.35	0.89	0.57	0.46	0.10	1.07
Kurtosis	5.90	1.88	2.18	1.85	1.85	1.82	2.48
Jarque-Bera	20.34	3.10	6.89	4.73	3.92	2.58	8.67
Probability	0.00	0.21	0.03	0.09	0.14	0.27	0.01
Observations	43	43	43	43	43	43	43

Source: Author's computation (2025) using Eview-9.

The descriptive statistics for money supply growth rate and physical capital reveal notable differences between Ghana and Nigeria. Ghana's money supply growth rate averaged 4.88% (range: 3.56% to 6.52%), while Nigeria's averaged 6.09% (range: 3.56% to 6.85%). Physical capital averaged $4,480 million in Ghana (range: $153 million to $15,100 million) and $38,800 million in Nigeria (range: $9,520 million to $81,300 million).

Correlation Analysis

Nigeria's correlation matrix

The correlation matrix presented in Table 2 revealed a face-hand relationship between the Nigeria variables. The correlation matrix for Nigeria's variables reveals a complex web of relationships. The real GDP growth rate exhibits a weak negative association with total fertility rate (-0.2395) indicating that increases in total fertility rate linked to slight decrease in economic growth.

Table 2: Correlation matrix of the Nigeria's variables, 1980 to 2023

	RGDPGR	TFR	GOVEX	INFRA	LAB	MSGR	PKY
RGDPGR	1						
TFR	-0.2395	1					
GOVEX	0.0933	-0.9268	1				
INFRA	0.2631	-0.9360	0.8900	1			
LAB	0.1813	-0.9606	0.9775	0.9469	1		
MSGR	0.1805	0.2016	-0.2807	-0.1151	-0.2373	1	
PKY	-0.1063	-0.7370	0.9050	0.7383	0.8593	-0.3214	1

Source: Author's computation (2025) using Eview-9.

Ghana's correlation matrix

The correlation matrix presented in Table 3 revealed a face-hand relationship between the Ghanaian variables. Total fertility rate (-0.4279) exhibits negative associations with real GDP growth rate, indicating that increases in TFR is linked to decreases in economic growth

Table 3: Correlation matrix of the Ghana's variables, 1980 to 2023

	RGDPGR	GOVEX	INFRA	LAB	MSGR	PKY	TFR
RGDPGR	1						
GOVEX	0.3352	1					
INFRA	0.2615	0.9186	1				
LAB	0.3017	0.9211	0.9863	1			
MSGR	-0.0815	-0.5368	-0.5541	-0.5715	1		
PKY	0.1679	0.9223	0.9268	0.8999	-0.5493	1	
TFR	-0.4279	-0.8112	-0.9007	-0.9312	0.5423	-0.7900	1

Source: Author's computation (2025) using Eview-9.

Unit root test results

Unit root result of Nigeria's variables

The unit root test results for Nigeria's variables in Table 4, based on the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, reveal a mix of stationary and non-stationary variables. While government expenditure, real GDP growth rate, and total fertility rate are non-stationary at levels but become stationary after first differencing (I(1)), infrastructure, labour force, money supply growth rate, and physical capital are stationary at levels (I(0)). This mixed order of integration justifies the use of the Autoregressive Distributed Lag (ARDL) estimation technique, ensuring reliable and unbiased estimates in subsequent analyses.

TABLE 4: The summarized result of the unit root test results of the study's variables

Variable	At level		At first difference		Remark
	ADF	PP	ADF	PP	
INFRA	-5.1747	-5.2283	NA	NA	I(0)
	(0.0007)	(0.0006)			
Log(GOVEX)	0.0454	-0.1579	-4.0784	-7.7514	I(1)
	(0.9956)	(0.9921)	(0.0135)	(0.0001)	
Log(LAB)	-3.5829	-3.8017	NA	NA	I(0)
	(0.0443)	(0.0260)			

MSGR	-3.8309	-3.9563	NA	NA	I(0)
	(0.0245)	(0.0179)			
Log(PKY)	-3.8090	-4.6018	NA	NA	I(0)
	(0.0263)	(0.0002)			
RGDPGR	-2.6355	-4.2708	-12.2389	-18.1961	I(0)/(1)
	(0.3899)	(0.8257)	(0.0001)	(0.0001)	
TFR	-2.3684	-1.4666	-4.0416	-4.1178	I(1)
	(0.3899)	(0.8257)	(0.0336)	(0.0155)	

Note: figures in parenthesis are the respective probability values of the unit root test results; NA = not applicable; the statistical significance of the unit root results is at 5 % level of significance.

Source: Author's computation (2025) using Eview-9.

Unit root result of Ghana's variables

The unit root test results for Ghana's variables in Table 5, based on the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, reveal a mix of stationary and non-stationary variables. Infrastructure, government expenditure, physical capital, and total fertility rate are non-stationary at levels but become stationary after first differencing (I(1)). In contrast, labour force, money supply growth rate, and real GDP growth rate are stationary at levels (I(0)). This mixed order of integration supports the use of the Autoregressive Distributed Lag (ARDL) estimation technique, allowing for reliable and unbiased estimates in subsequent analyses.

TABLE 5: The summarized result of the unit root test results of the Ghana's variables

Variable	At level		At first difference		Remark
	ADF	PP	ADF	PP	
INFRA	-2.6722	-2.6722	-6.6722	-11.8523	I(1)
	(0.2527)	(0.2527)	(0.0001)	(0.0001)	
Log(GOVEX)	-2.6697	-2.6697	-5.5441	-5.5369	I(1)
	(0.2536)	(0.2536)	(0.0002)	(0.0002)	
Log(LAB)	-3.3795	-3.5426	NA	NA	I(0)
	(0.0293)	(0.0499)			
MSGR	-5.4622	-7.1867	NA	NA	I(0)
	(0.0003)	(0.0001)			
Log(PKY)	-2.5164	-2.5164	-6.9663	-7.1012	I(1)

	(0.3191)	(0.3191)	(0.0001)	(0.0001)	
RGDPGR	3.6653	-3.6492	NA	NA	I(0)
	(0.0361)	(0.0424)			
TFR	-0.6038	-0.9797	-4.7549	-4.7344	I(1)
	(0.9737)	(0.9363)	(0.0022)	(0.0023)	

Source: Author's computation (2025) using Eview-9.

Analysis of the results

Analysis of the results of Ghana

Optimal lag selection of the Ghana's model

The study used Vector Autoregression (VAR) lag order selection criteria to determine the optimal lag lengths, employing the Akaike Information Criteria (AIC). The AIC results revealed that the optimal lag length was two (2), indicating that the current values of economic variables are influenced by their values two periods ago. By balancing model complexity and goodness of fit, the AIC provides a reliable indicator of optimal lag length, supporting the choice of two lags for the model.The outcome of the lag selection process is presented in Table 6.

Table 6: Optimal lag selection results of the Ghana's model

VAR Lag Order Selection Criteria

Endogenous variables: RGDPGR LOG(GOVEX) INFRA LOG(LAB) MSGR LOG(PKY) TFR

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-360.254	NA	0.222607	18.36272	18.65827	18.46958
1	-69.9337	464.5131*	1.33e-06*	6.296683*	8.661114*	7.151586*
2	-38.6642	39.08686	4.07E-06	7.183208	11.61652	8.786153
3	11.94369	45.54707	7.47E-06	7.102816	13.605	9.453801

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Source: Author's computation (2025) using Eview-9.

Bounds test of cointegration result

The Bounds test, developed by Pesaran et al. (2001), was used to determine the existence of long-run relationships among the variables in the ARDL model. The results, presented in Table 7, show a statistically significant F-statistic value of 4.2332, exceeding the critical values at the 5% significance level (upper bound: 3.61, lower bound: 2.45). This provides strong evidence of cointegration, indicating a long-run relationship among the variables.

Table 7: Bound test results for long run relationships among the Ghana's model

Null Hypothesis: No levels relationship					
Test Statistic	Value	Signif.	I(0)	I(1)	
			Asymptotic: n=1000		
F-statistic	4.2332	10%		2.12	3.23
K	6	5%		2.45	3.61
		2.50%		2.75	3.99
		1%		3.15	4.43

Source: Author's computation (2025) using Eview-9.

Linear Autoregressive Distributed Lag (ARDL) short run and ECM results for Ghana model

Table 8 shows the short-run ARDL results of the Ghana model. The short-run ARDL coefficient of TFR is -8.4670 with a probability value of 0.0005. This revealed a negative and statistically significant impact of total fertility rate on real GDP growth rate at a one percent level of significance. This means that one percent increase in TFR will lead to a 8.47 percent decrease in real GDP growth rate in Ghana in the short run period.

Table 8: Linear Autoregressive Distributed Lag (ARDL) short run and ECM results of Ghana's model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Dependent Variable: RGDPGR				
Selected Model: ARDL(1, 0, 0, 0, 0, 1, 0)				
DLOG(GOVEX)	5.7340	1.5734	3.6442	0.0009
D(INFRA)	0.0854	0.1113	0.7675	0.4482
DLOG(LAB)	-18.0091	10.2610	-1.7551	0.0885
D(MSGR)	0.0454	0.0344	1.3198	0.1960
DLOG(PKY)	0.2955	1.8081	0.1634	0.8712
D(TFR)	-8.4670	2.1909	-3.8647	0.0005
ECT(-1)	-0.8018	0.1375	-5.8307	0.0001
Adjusted R-squared	0.6085		Durbin-Watson stat	1.9599
F-statistic	8.9659		Prob(F-statistic)	0.0001
Breusch-Godfrey Serial Correlation LM Test: Prob. F(2,31)				
F-statistic	1.6231			0.2136
Prob. Chi-Square(2)				
Obs*R-squared	3.9811			0.1366
Heteroskedasticity Test: Breusch-Pagan-Godfrey Prob. F(8,33)				
F-statistic	0.8544			0.5633
Prob. Chi-Square(8)				
Obs*R-squared	7.2068			0.5145
Prob. Chi-Square(8)				
Scaled explained SS	7.9857			0.4349

Source: Author's computation (2025) using Eview-9.

The error correction coefficient indicates that 80.18% of short-run disequilibrium is corrected in the long run, suggesting a relatively fast speed of adjustment. The model has a modest fit, with 60.85% of the variation in economic growth explained by the independent variables. The diagnostic tests confirm the model's reliability, showing no autocorrelation, serial correlation, or heteroscedasticity.

Linear Autoregressive Distributed Lag (ARDL) long-run results of Ghana's model

Table 9 shows the long-run ARDL results of the Ghana model. The long-run ARDL coefficient of TFR is -10.5597 with a probability value of 0.0028. This revealed a negative and statistically significant impact of total fertility rate on real GDP growth rate at a five percent level of significance. This means that one percent increase in TFR will lead to a 10.56 percent decrease in real GDP growth rate in Ghana in the long run period.

Table 9: Linear Autoregressive Distributed Lag (ARDL) long run results of Ghana's model

Dependent Variable: RGDPGR				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(GOVEX)	7.1512	2.0009	3.5740	0.0011
INFRA	0.1065	0.1463	0.7281	0.4717
LOG(LAB)	-22.4604	13.7203	-1.6370	0.1111
MSGR	0.0567	0.0424	1.3373	0.1903
LOG(PKY)	-8.1418	2.7928	-2.9153	0.0063
TFR	-10.5597	3.2739	-3.2255	0.0028
Constant	432.5779	243.5805	1.7759	0.0850

Source: Author's computation (2025) using Eview-9.

Stability test for the estimated Ghana model

The CUSUM test results for the Ghana model, presented in Figure 1, indicate that the variables exhibit remarkable consistency throughout the study period. The CUSUM plot remains within the 5% significance level bounds, suggesting that the model's parameters are stable and do not suffer from structural instability or breaks. This stability implies that the estimated model is robust and reliable for long-run policy decisions, providing a solid foundation for long-term planning and policy interventions.
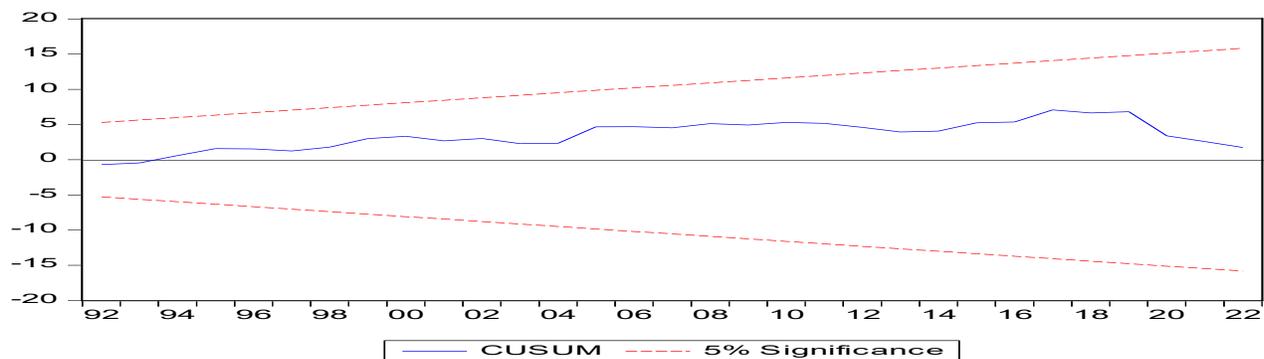

Figure 1 : The ARDL cumulative sum graph for the test of stability of the estimated Ghana model

Analysis of the results of Nigeria

Optimal lag selection of the Nigeria model

The study used Vector Autoregression (VAR) lag order selection criteria, specifically the Akaike Information Criteria (AIC), to determine the optimal lag length. The AIC results revealed that the optimal lag length was three (3), as presented in Table 10. This suggests that the current values of the variables are influenced by their values up to three periods ago.

TABLE 10: Optimal lag selection results of the Nigeria model

VAR Lag Order Selection Criteria						
Endogenous variables: RGDPGR LOG(GOVEX) INFRA LOG(LAB) MSGR LOG(PKY) TFR						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-384.96	NA	0.47481	19.1202	19.4128	19.2268
1	-52.578	535.062	4.88E-07	5.29648	7.636969*	6.14876
2	21.3913	93.8145	1.79E-07	4.07847	8.46689	5.67649
3	104.12	76.67508*	6.47e-08*	2.433188*	8.86953	4.776950*

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Source: Author's computation (2025) using Eview-9.

Bounds test of cointegration result of the Nigeria model

The Bounds test results, presented in Table 11, show a statistically significant F-statistic value of 10.40465, exceeding the critical values at the 5% significance level. This provides strong evidence of cointegration among the variables, indicating a long-run relationship.

Table 11: Bound test results for long-run relationships in the Nigeria model

Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	K
F-statistic	10.40465	6
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.50%	2.75	3.99
1%	3.15	4.43

Source: Author's computation (2025) using Eview-9.

Linear Autoregressive Distributed Lag (ARDL) short run and ECM results for Nigeria model

As displayed in TABLE 12, The result showed that the short-run coefficient of total fertility rate,D(TFR), is -26.6782 with a corresponding probability value of 0.1045. This shows a negative but not statistically significant impact of total fertility rate on economic growth in Nigeria at a 5 percent level of significance. This means that a one percent increase in total fertility rate will lead to about a 26.68 percent decrease in real GDP growth rate in Nigeria, all other things being equal.

Table 12: Linear Autoregressive Distributed Lag (ARDL) short run and ECM results of Nigeria's model

Dependent Variable: RGDPGR				
Selected Model: ARDL(1, 3, 3, 2, 2, 1, 1)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(GOVEX)	-1.2523	2.6870	-0.4661	0.6460
DLOG(GOVEX(-1))	1.9827	2.8235	0.7022	0.4903
DLOG(GOVEX(-2))	-6.2431	2.8814	-2.1667	0.0419
D(INFRA)	-0.4013	0.2407	-1.6673	0.1103
D(INFRA(-1))	0.5392	0.2462	2.1897	0.0400
D(INFRA(-2))	0.3014	0.2586	1.1657	0.2568
DLOG(LAB)	295.5497	130.1858	2.2702	0.0338
DLOG(LAB(-1))	-470.1052	121.4078	-3.8721	0.0009
D(MSGR)	0.0337	0.0357	0.9428	0.3565
D(MSGR(-1))	-0.1002	0.0339	-2.9578	0.0075
DLOG(PKY)	-7.2231	2.8750	-2.5124	0.0202
D(TFR)	-26.6782	15.7225	-1.6968	0.1045
ECT(-1)	-0.6980	0.1347	-5.1823	0.0000

Adjusted R-squared	0.7508	Durbin-Watson stat	2.0632
F-statistic	7.3438	Prob(F-statistic)	0.0000

Breusch-Godfrey Serial Correlation LM Test:
Prob. F(3,18)

F-statistic	0.8836	0.4683
	Prob. Chi-Square(3)	
Obs*R-squared	5.2627	0.1535

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Prob. F(19,21)

F-statistic	0.7896	0.6957
	Prob. Chi-Square(19)	
Obs*R-squared	17.0845	0.5841
	Prob. Chi-Square(19)	
Scaled explained SS	2.4387	1.0000

Source: Author's computation (2025) using Eview-9.

The error correction coefficient indicates that 69.8% of short-run disequilibrium is corrected in the long run, suggesting a relatively fast speed of adjustment. The model has a modest fit, with 78.96% of the variation in economic growth explained by the independent variables. Diagnostic tests confirm the model's reliability, showing no autocorrelation, serial correlation, or heteroscedasticity.

Linear Autoregressive Distributed Lag (ARDL) long-run results of Nigeria's model

Table 13 shows the long-run ARDL results of the Nigeria model. As displayed in TABLE 14, The long-run ARDL coefficient of TFR is 17.925 with a probability value of 0.037. This revealed a positive and statistically significant impact of total fertility rate on real GDP growth rate at a five percent level of significance. This means that one percent increase in TFR will lead to a 17.93 percent increase in real GDP growth rate in Nigeria in the short run period.

Table 13: Linear Autoregressive Distributed Lag (ARDL) long-run results of Nigeria's model

Dependent Variable: RGDPGR				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(GOVEX)	4.58838	2.43309	1.88582	0.0732
INFRA	-1.4679	0.94188	-1.5585	0.1341
LOG(LAB)	91.2968	35.3161	2.58513	0.0173
MSGR	0.14131	0.09948	1.42061	0.1701

LOG(PKY)	-18.802	4.34532	-4.327	0.0003
TFR	17.9225	8.09336	2.21447	0.0380
Constant	-1317.9	577.104	-2.2837	0.0329

Source: Author's computation (2025) using Eview-9.

Stability test for the estimated Nigeriamodel

The CUSUM test results for the Nigeria model, presented in Figure 2, indicate that the variables exhibit remarkable consistency throughout the study period. The CUSUM plot remains within the 5% significance level bounds, suggesting that the model's parameters are stable and do not suffer from structural instability or breaks. This stability implies that the estimated model is robust and reliable for long-run policy decisions, providing a solid foundation for long-term planning and policy interventions.
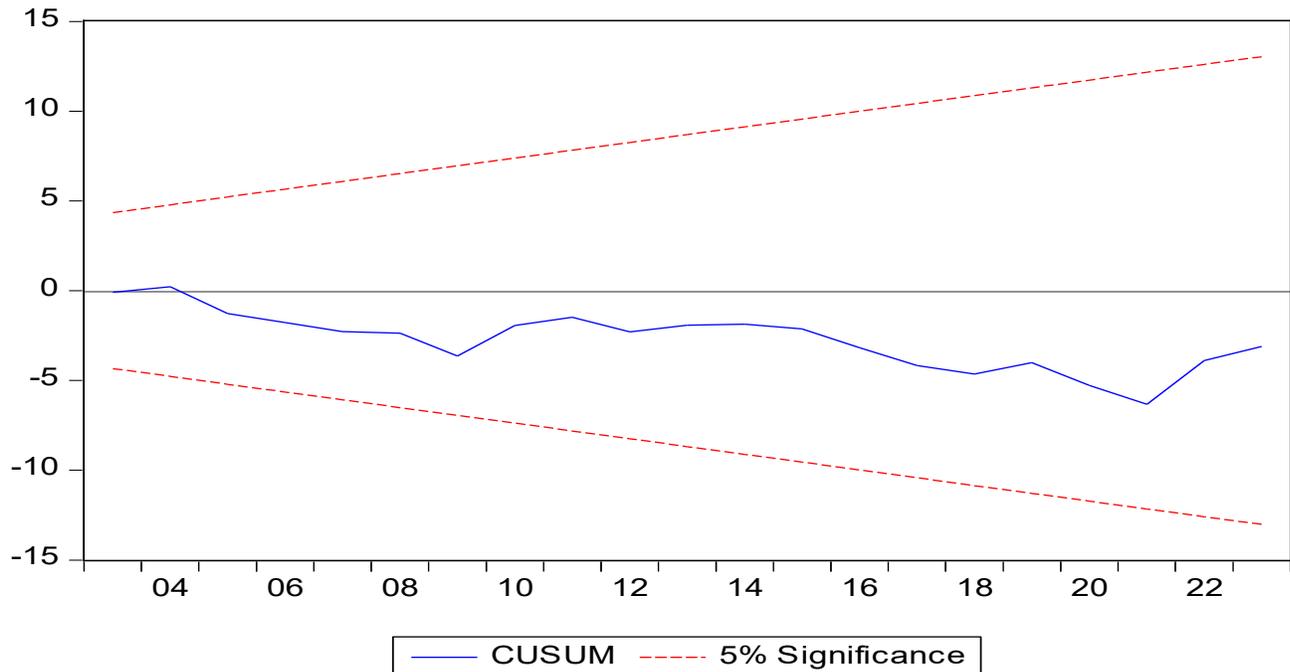

FIG 2: The ARDL cumulative sum graph for the test of stability of the estimated Nigeriamodel

DISCUSSION OF FINDINGS

The study found that the total fertility rate has a negative but not statistically significant impact on economic growth in Nigeria at a 5 per cent level of significance in the short-run period. The empirical result suggests that an increase in total fertility rate (TFR) leads to a decrease in real GDP growth rate in Nigeria in the short run, although the impact is not statistically significant at a 5 percent level. This finding is partially consistent with the Malthusian theory, which posits that high fertility rates can hinder economic growth and lead to poverty.

The result also agreed with previous studies that have found a negative relationship between fertility rates and economic growth, such as Aigheyisi and Oligbi (2019) who found that adolescent fertility has a significant negative relationship with economic growth, and Bairoliya and Miller (2021) who found that fertility decline can lead to a decrease in labour force participation and economic growth in the short run. However, it is worth noting that the impact of total fertility rate on economic growth in Nigeria is not statistically significant, which may suggest that other factors, such as education, healthcare, and institutional quality, may play a more significant role in determining economic growth in the country.

The study found that the total fertility rate has a positive and statistically significant impact on economic growth in Nigeria at a one per cent level of significance in the long run. This means that an increase in total fertility rate will lead to an increase in real GDP growth rate, a proxy for economic growth, in Nigeria, all other things being equal. The empirical result suggests that the total fertility rate (TFR) has a positive and statistically significant impact on economic growth in Nigeria in the long run. This finding contradicts the conventional wisdom that high fertility rates hinder economic growth and lead to poverty. Instead, the result suggests that an increase in TFR will lead to an increase in real GDP growth rate, a proxy for economic growth, in Nigeria. This finding is inconsistent with some previous studies, such as Yulianita et al. (2020) and Sohail et al. (2024), which found that fertility decline can lead to increased per capita income growth and labour force participation rates, and improved standard of living and reduced poverty, respectively.

However, the finding is consistent with other studies that have found a positive relationship between fertility rates and economic growth in the long run. For instance, Dominiak et al. (2015) and Lacalle-Calderon et al. (2017) found that economic development can lead to increased fertility rates once a critical threshold of GDP per capita is reached. This suggests that as Nigeria's economy grows and develops, fertility rates may increase, leading to a positive impact on economic growth. The finding also highlights the importance of human capital accumulation in driving economic growth, as Li and Zhao (2022) found that human capital accumulation is a significant driver of TFP growth and decomposition.

The study found a negative and statistically significant impact of total fertility rate on economic growth in Ghana at a one percent level of significance in both the short run and the long run periods. This means that an increase in total fertility rate will lead to a decrease in real GDP growth rate, a proxy for economic growth, in Ghana, all other things being equal, in both the short run and the long run periods. The empirical result suggests that the total fertility rate (TFR) has a negative and statistically significant impact on economic growth in Ghana in both the short run and the long run periods. This finding supports the Malthusian theory, which posits that high fertility rates can hinder economic growth and lead to poverty. The result implies that an increase in TFR will lead to a decrease in the real GDP growth rate, a proxy for economic growth, in Ghana. This finding is consistent with previous studies that have found a negative relationship between fertility rates and economic growth, such as Aigheyisi and Oligbi (2019), who found that adolescent fertility has a significant negative relationship with economic growth.

The finding also suggests that fertility decline can have a negative impact on human capital accumulation and TFP growth in the long run, as found by Li and Zhao (2022). This implies that

policies aimed at reducing fertility rates may have unintended consequences on economic growth in the long run. Furthermore, the finding is consistent with Huang's (2021) study, which found that secular fertility declines can significantly contribute to slowing global economic growth.

The impact of the total fertility rate on economic growth in Nigeria and Ghana differs. In Nigeria, the total fertility rate has a negative but not statistically significant impact on economic growth in the short run, but a positive and statistically significant impact in the long run. In contrast, Ghana experiences a statistically significant negative impact on economic growth from its total fertility rate in both the short and long run periods. Therefore, the study concludes that the impact of the total fertility rate on economic growth differs between Nigeria and Ghana, with Nigeria experiencing a positive long-term impact and Ghana experiencing a negative impact in both the short and long term.

Summary, Conclusion and Policy Recommendations

This study aimed to investigate the relationship between human fertility and economic growth, with a focuson Nigeria and Ghana. The objectives were to examine the impact of fertility on economic growth in each country and compare the findings between Nigeria and Ghana using annual time series data from 1980 to 2023. Empirical literature and theoretical literature related to the study were reviewed. The study adopted the descriptive and analytical research design. It employed the ARDL estimation technique.

The study made the following findings: The study found total fertility rate has a negative but not statistically significant impact of total fertility rate on economic growth in Nigeria at a 5 percent level of significance in the short run period, while the long run total fertility rate a positive and statistically significant impact of total fertility rate on economic growth in Nigeria at a one percent level of significance in the long run. Total fertility rate has a negative and statistically significant impact on economic growth in Ghana at a one per cent level of significance in both the short run and long run periods; and the impact of human fertility on economic growth is not the same in Nigeria and Ghana.

Conclusion

The impact of the total fertility rate on economic growth in Nigeria and Ghana differs. In Nigeria, the total fertility rate has a negative but not statistically significant impact on economic growth in the short run, but a positive and statistically significant impact in the long run. In contrast, Ghana experiences a statistically significant negative impact on economic growth from its total fertility rate in both the short and long run periods. Therefore, the study concludes that the impact of the total fertility rate on economic growth differs between Nigeria and Ghana, with Nigeria experiencing a positive long-term impact and Ghana experiencing a negative impact in both the short and long term.

Policy Recommendations

The study recommends that the total fertility rate has a positive and statistically significant impact on economic growth in Nigeria at a one percent level of significance in the long run. The study recommends that various government and institutional agencies must work together to achieve long-term economic growth, such as the Ministry of Education, National Commission for Colleges of Education, and National Universities Commission, to implement policies to improve education quality and access. The National Population Commission, the Ministry of Health, and the National Agency for the Control of AIDS can implement family planning programs and provide access to reproductive health services. The Ministry of Health, the National Health Insurance Scheme, and the National Primary Health Care Development Agency should implement policies to improve access to and quality healthcare. Furthermore, the Ministry of Education, the National Board for Technical Education, and the Industrial Training Fund can implement vocational training programs to equip young people with skills.

The study also recommends that, given the negative and statistically significant impact of total fertility rate on economic growth in Ghana at a one percent level of significance in the short run and the long run periods, family planning programs should be implemented to reduce total fertility rates and promote economic growth. The Ghana Health Service can implement family planning programs, provide access to contraceptives and reproductive health services, and educate the public about the benefits of family planning. The Ministry of Education can integrate family planning and reproductive health education into school curricula, promoting education and awareness about the benefits of family planning. The Ministry of Gender, Children and Social Protection can empower women through education, economic opportunities, and social protection, and promote women's rights and reproductive health. The National Population Council can provide technical assistance and support for family planning programs, as well as monitor and evaluate the impact of these programs on economic growth.

 Finally, the Ministry of Finance can allocate resources and budget for family planning programs, education, and human capital development to promote economic growth.

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